

The Natural Flow Regime in Massachusetts Rivers

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Massachusetts Streamflow Conference, Apr. 29, 2005

Human influences cause flow conditions in some rivers to fluctuate outside their natural range of variability...



Ipswich River, drainage area = 130 mi²

9/9/1999 18:00



IRWA, 1999

... with adverse consequences

No-flow conditions in the headwaters of the Ipswich River caused fish kills in reaches adjacent to where ground water is withdrawn for public water-supply.



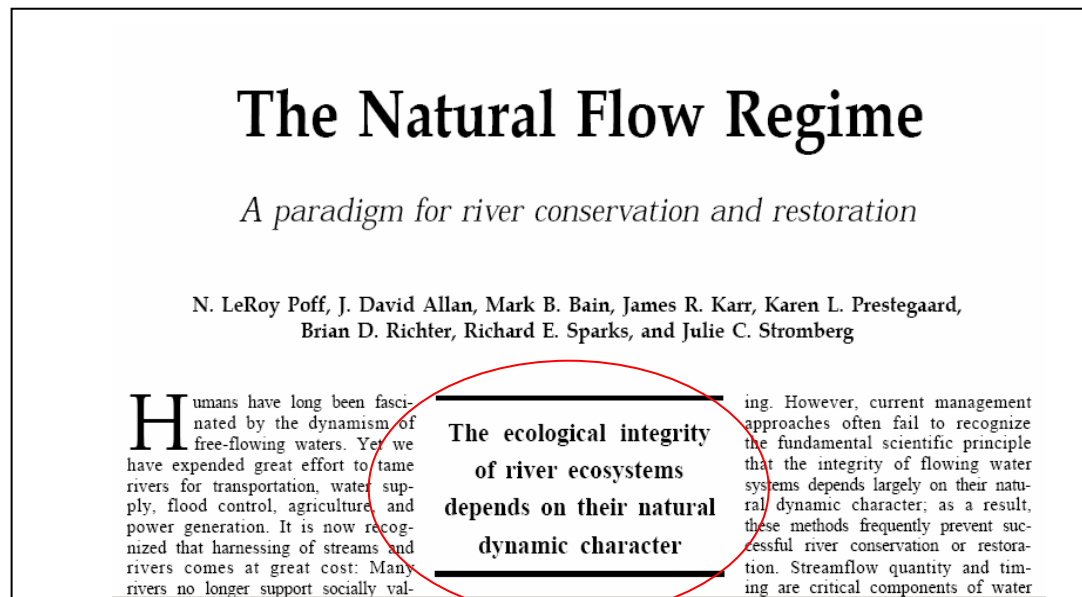
MA AUDUBON, 2000

Ipswich River, Reading/North Reading, D.A. = 18 mi²

“What streamflows are needed to maintain the biological integrity of rivers in Massachusetts ?

The **Natural Flow Regime** paradigm (Poff and others, 1997), states:

“The full range of natural flows is critical in sustaining the native biodiversity and ecosystem integrity in rivers”

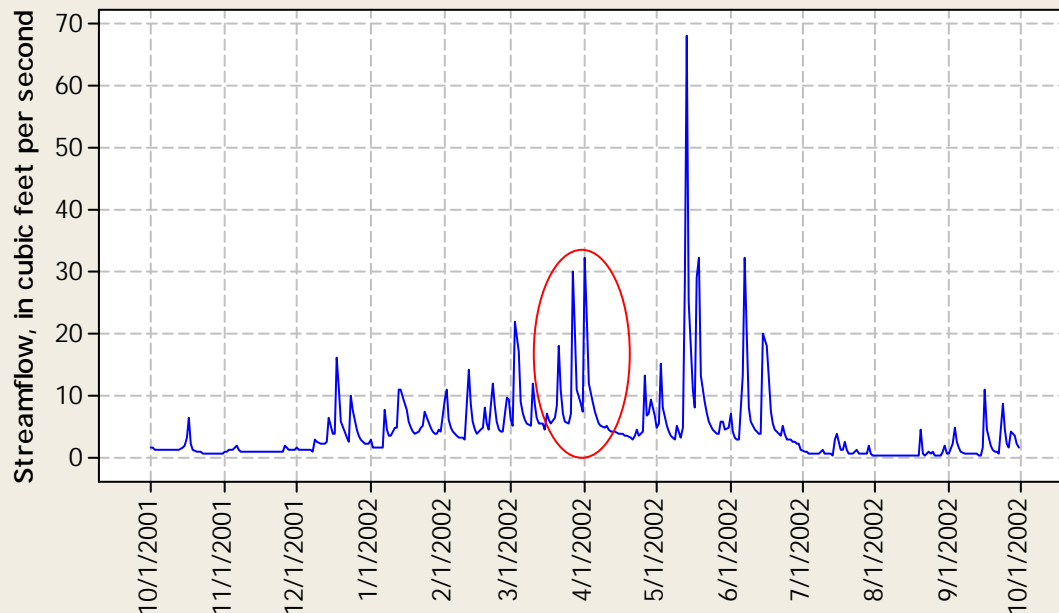


Poff, and others, 1997, The Natural Flow Regime: BioScience, v.47, no.11, p 769-784

The Natural Flow Paradigm assumes that native species have adopted to the natural range of flows

For example, herring spawning runs require high spring flows for herring to find rivers. Spawning is triggered by flows of specific temperatures.

Old Swamp River near South Weymouth, WY 2002



4/17/2002



Many river managers are using the **natural variability** of streamflow as a guide for ecosystem management (Richter and others, 1997).

SPECIAL APPLIED ISSUES SECTION

How much water does a river need?

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Richter and others, 1997, How much water does a river need?: Freshwater Biology, v. 37, p. 231-249

What is a **Natural Flow Regime** ?

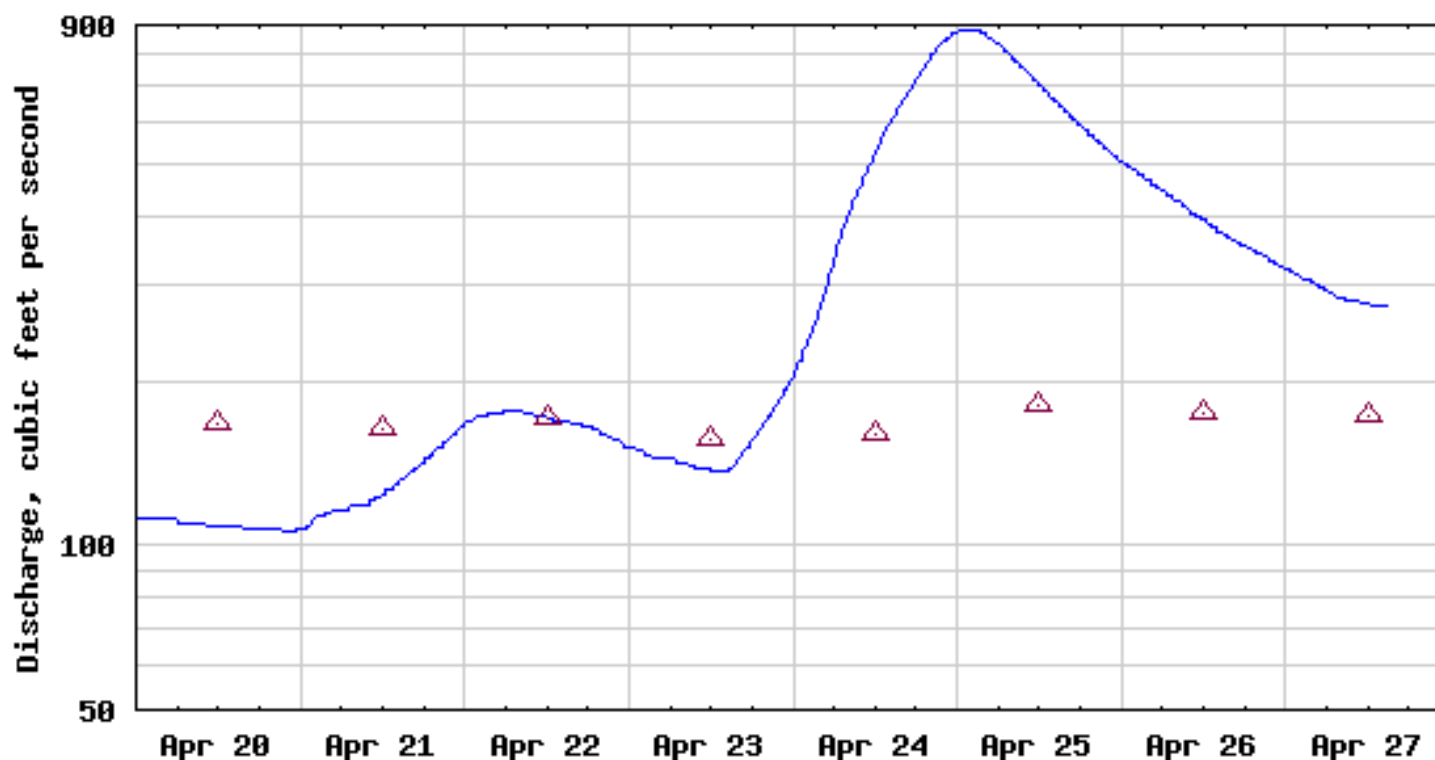
- A description of the characteristic patterns of flow in a river.



Streamflows are naturally variable. The natural flow of a river varies on time scales of hours and days, ...



USGS 01096000 SQUANNACOOK RIVER NEAR WEST GROTON, MA



----- EXPLANATION -----

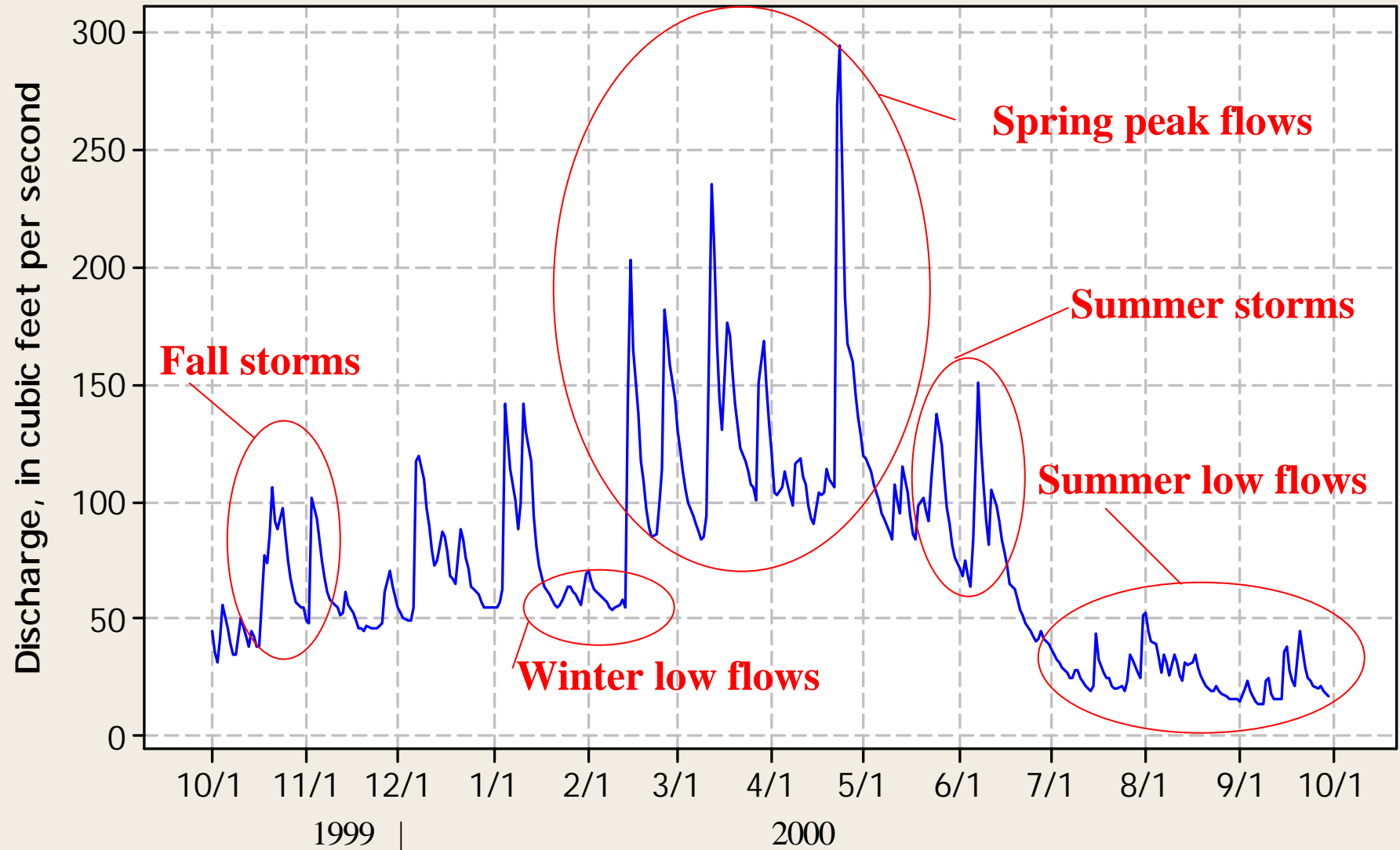
— DISCHARGE

△ MEDIAN DAILY STREAMFLOW BASED ON 55 YEARS OF RECORD

Provisional Data Subject to Revision

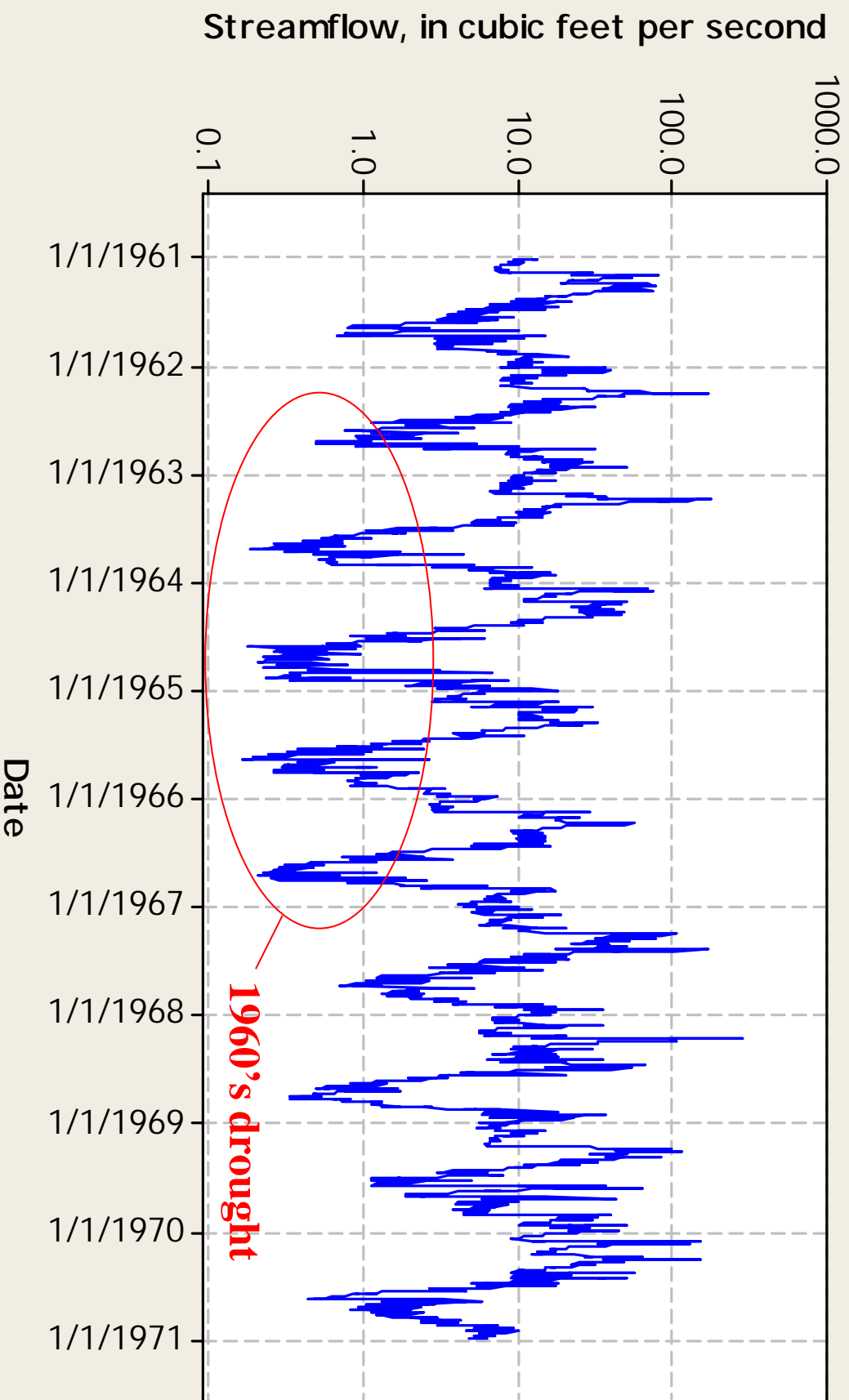
..., seasons,

Wood River near Acadia RI, WY 2000



...and between years, decades, and longer periods

Severn mile River near Spencer

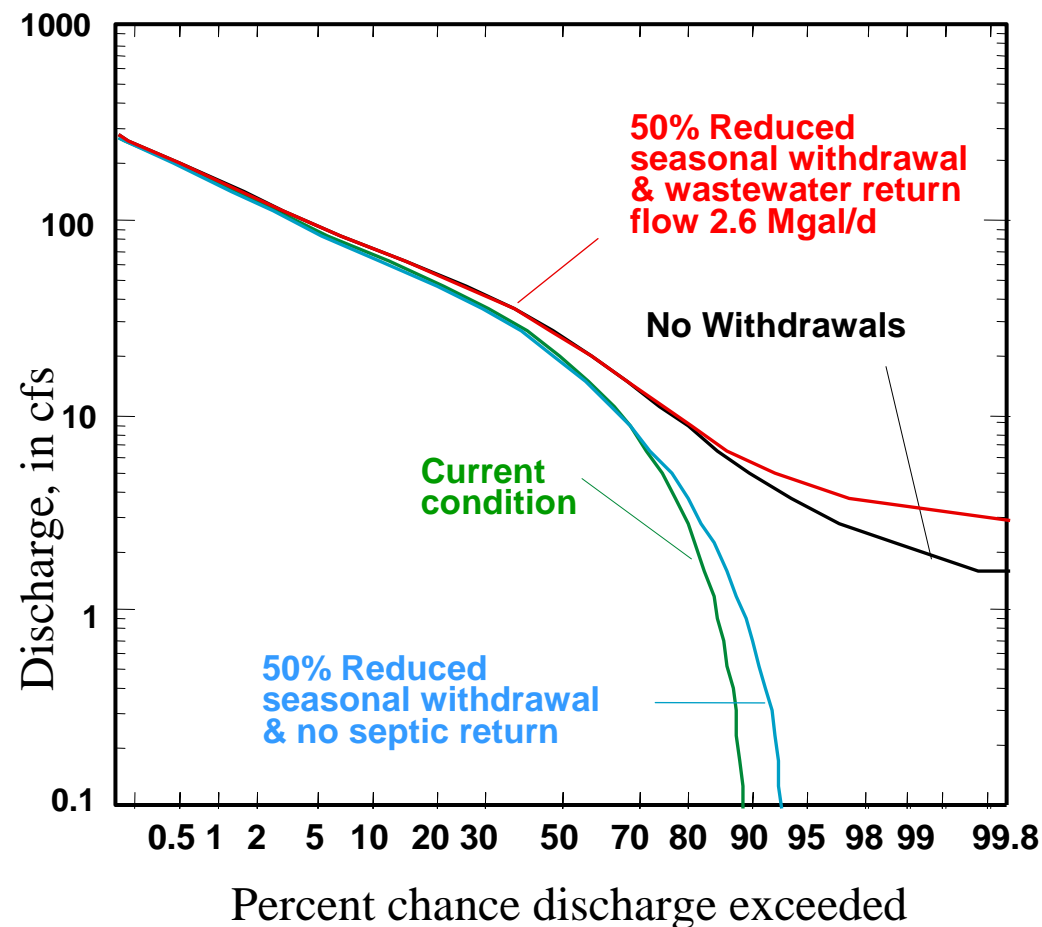


Streamflows conditions are characterized
by using flow statistics that describe

- **Magnitude** - How much water ?
- **Frequency** - How often ?
- **Duration** - How long do flow conditions persist ?
- **Timing** - When do flow events occur ?
- **Rate of Change** - Is the flow regime flashy or stable ?

How are natural flow regimes determined ?

- Long-term streamflow records from naturally-flowing rivers
- Simulation models



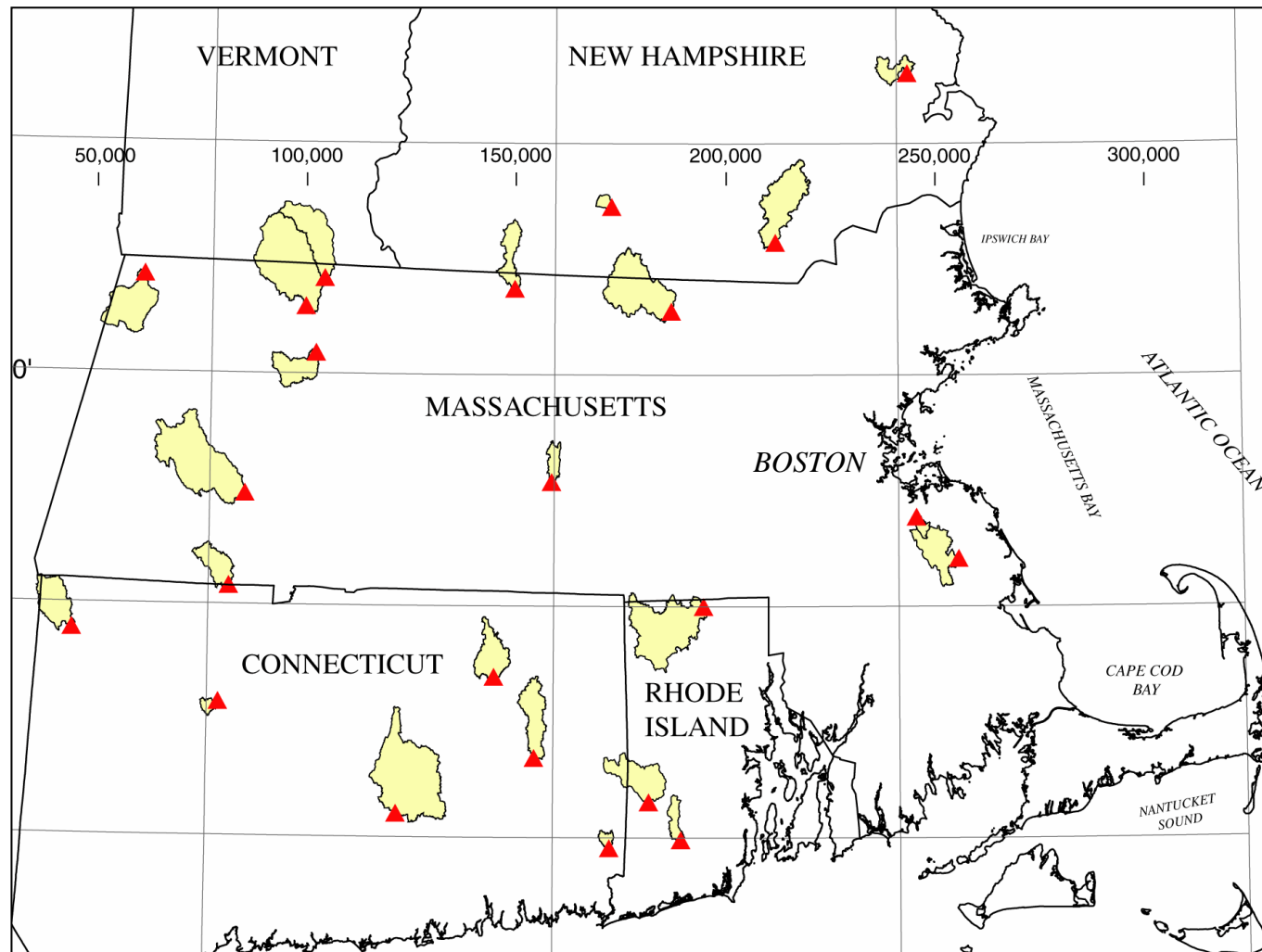


WATER DATA

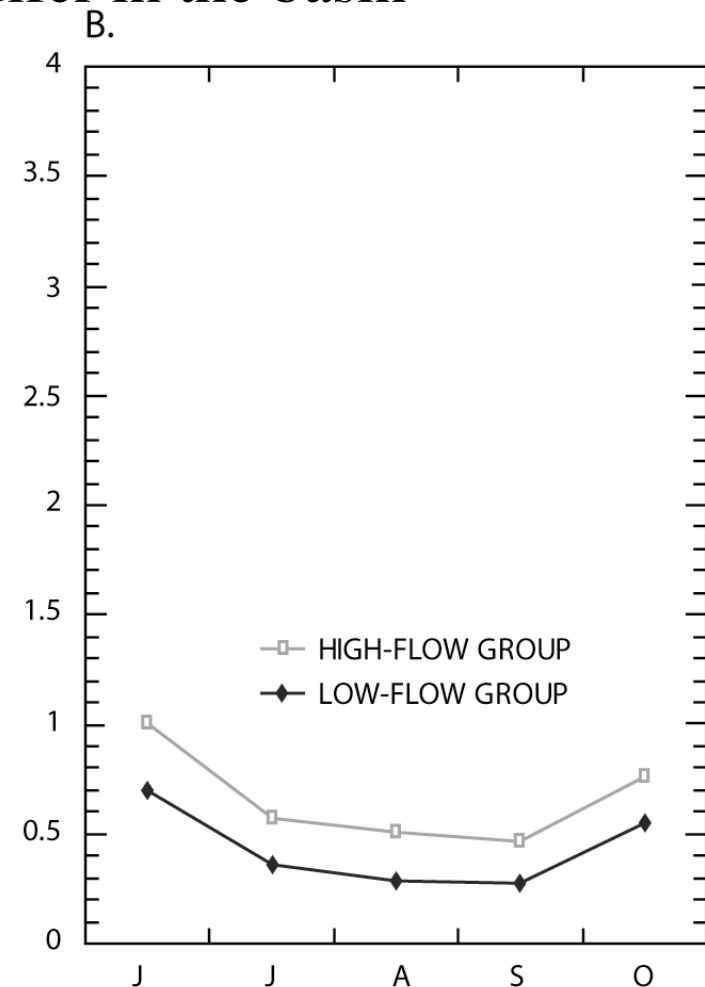
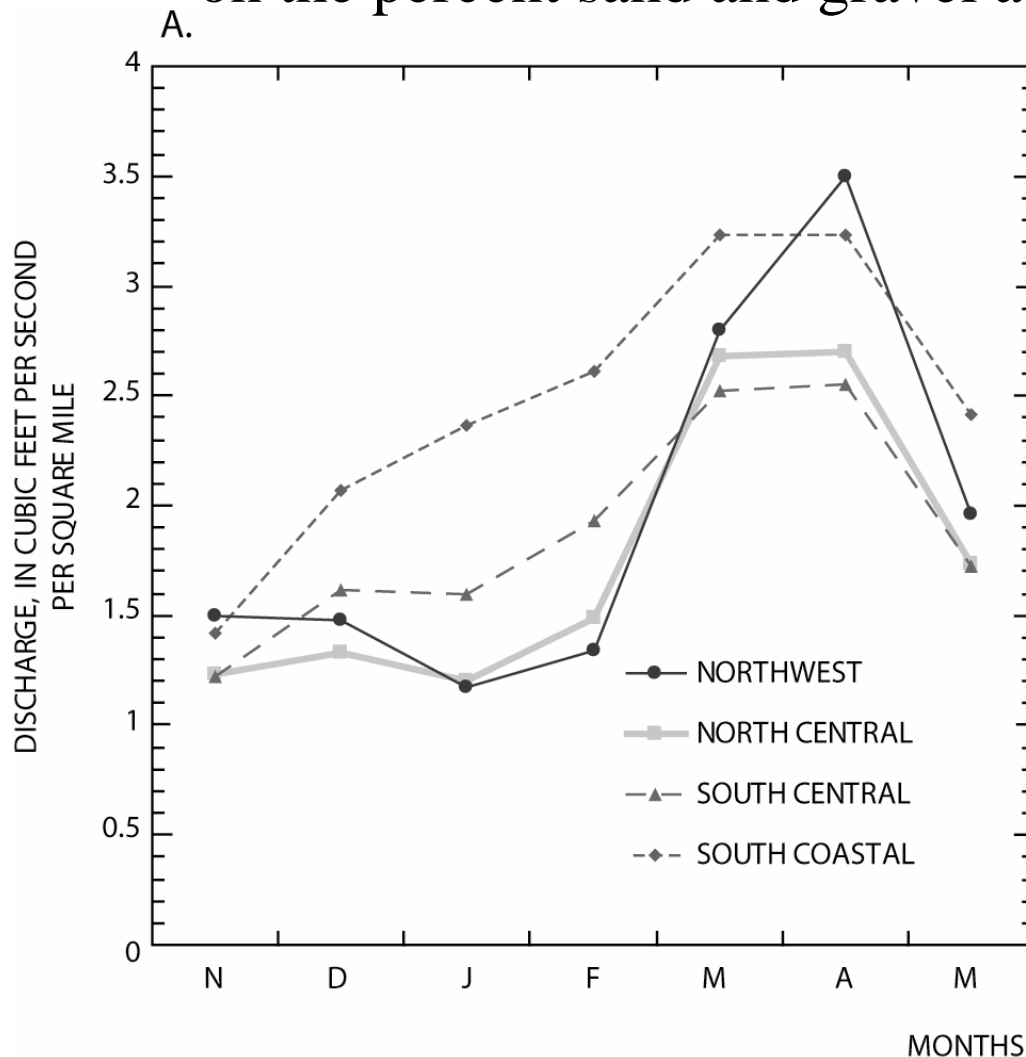


The USGS MA-RI Water Science Center maintains a network of 112 long-term streamflow-gaging stations, some with records up to 100 years.

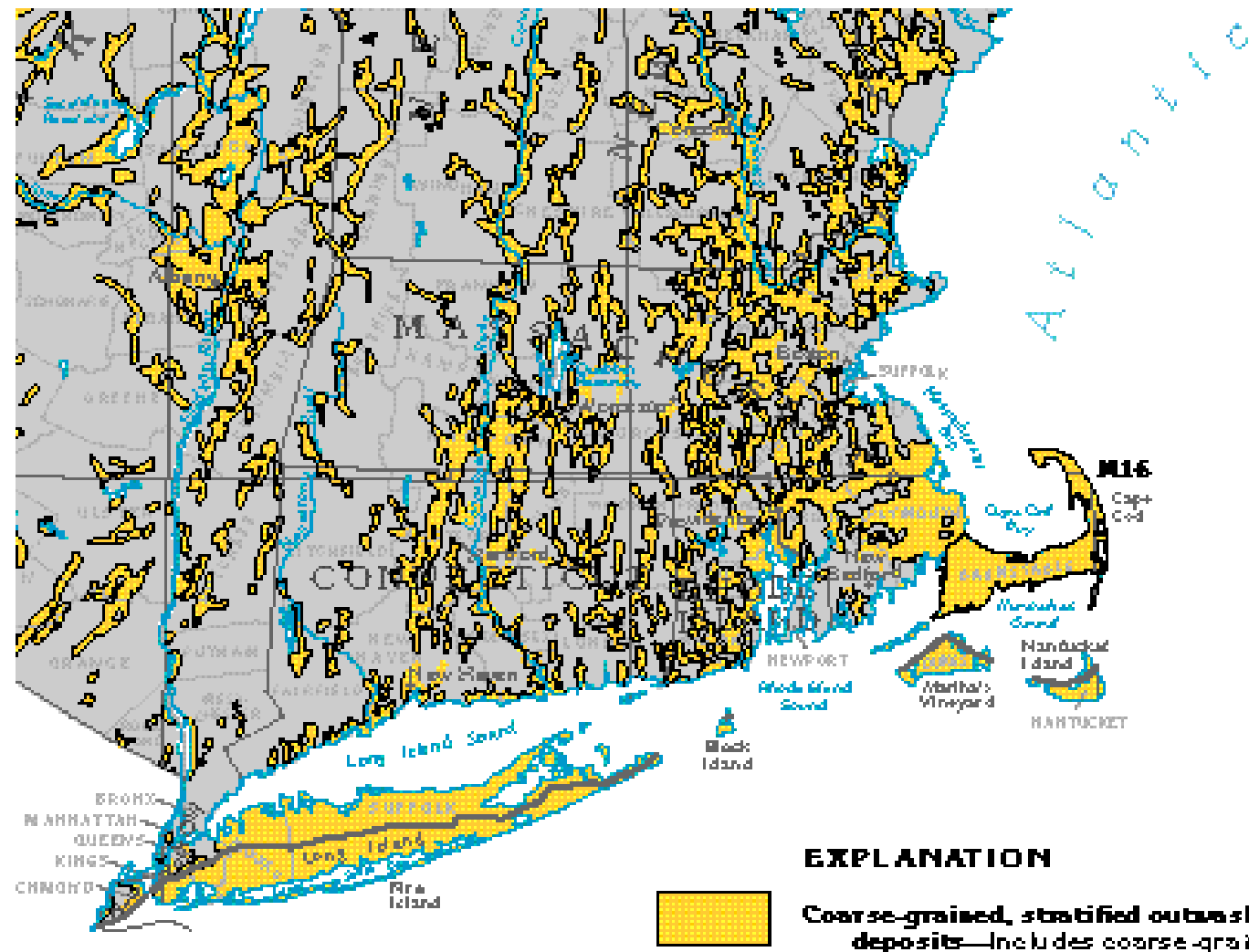
Recently the USGS assessed the flow regimes, fish communities, and habitat conditions for 23 “relatively-natural” (least-altered) rivers in Southern New England.



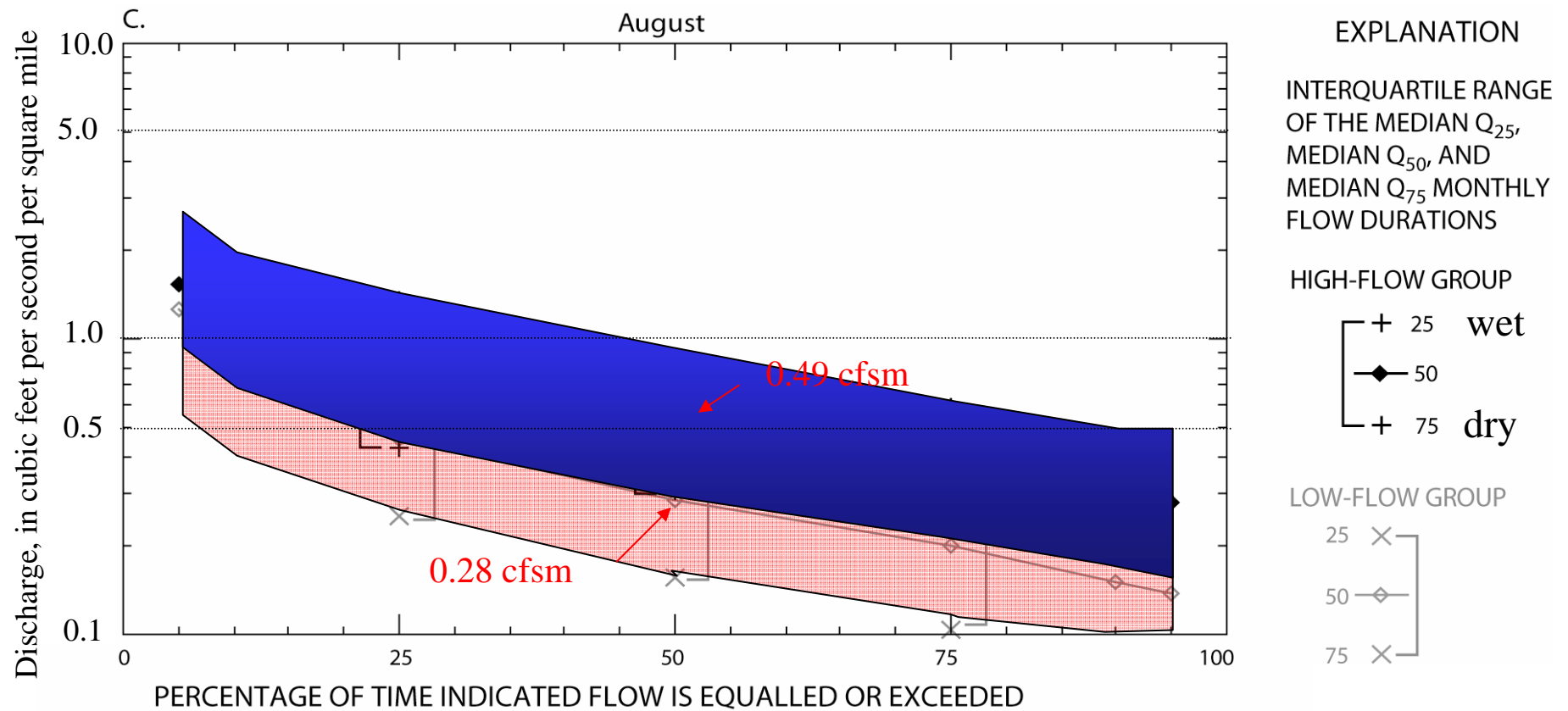
- Annual flow regimes were characterized using median monthly flows for the 1976 - 2000 period
- Median flows during high-flow months (Nov – May) varied by region
- Median flows during low-flow months (June – Oct) varied depending on the percent sand and gravel aquifer in the basin



Streamflows vary not only over time; they also vary depending on the location, and the basin characteristics (slope, percent sand and gravel) of the river basin.



There is natural variation around the median monthly flow



To make an analogy between

The “Field of Dreams”

and

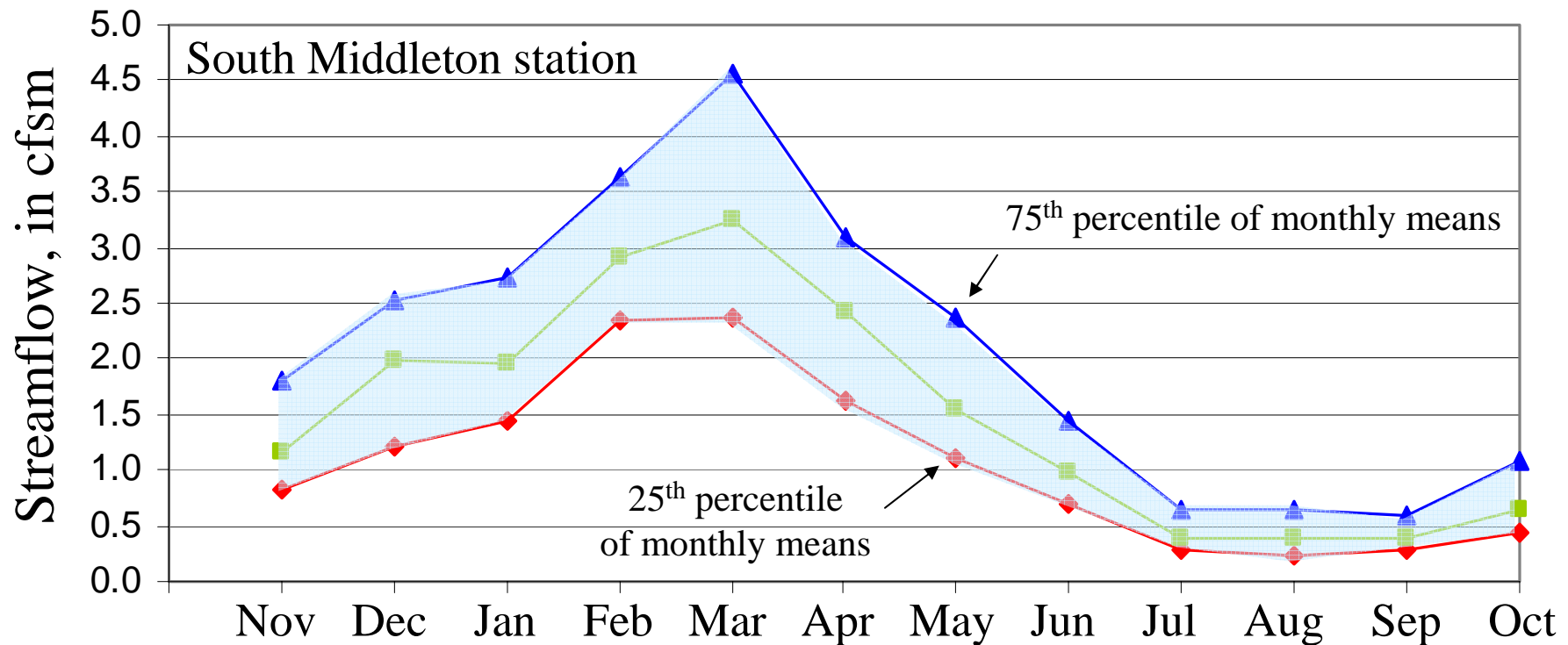
The “River of Dreams”...



...If you build it, they will come

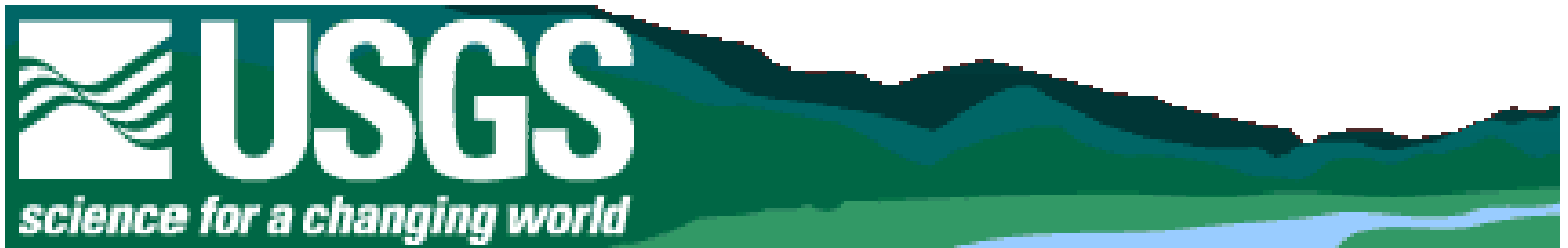
(a natural flow regime)

**(native biodiversity
and ecosystem integrity)**



EXPLANATION

 RVA Streamflow Management Targets



Streamflow requirements and statistics determined from USGS studies are being used to guide the development of stream flow policies and water-withdrawal regulations in Massachusetts

